Remarks

Claims 1-21 are pending in the current application. No new matter has been added.

Rejection based on 35 USC §102

Claims 1 and 2 have been rejected under 35 USC §102(e), as being anticipated by U.S. Patent No. 5,969,424 (Pierpaoli). In making the rejection, the Examiner asserts that Pierpaoli discloses a method to significantly reduce bias and variance of diffusion anisotropy measurements comprising the method of the present invention. However, Applicants respectfully traverse the rejection because, even though both Pierpaoli and Applicants disclose methods for improving Magnetic Resonance Imaging (MRI), they address very different elements of MRI and very different methods of improving MRI.

As cited by the Examiner, Pierpaoli teaches a quantitative and objective measure of anisotropy which is immune to noise induced bias effects (col. 15, lines 47-49). Pierpaoli focuses on a method of assessing "diffusion anisotropy," *i.e.*, a dependence of the diffusion on direction. These measures of diffusion anisotropy help clinicians infer microstructural characteristics of the imaged tissues. Specifically, Pierpaoli focuses on measures of diffusion anisotropy in Diffusion-Weighted Imaging (DWI). In fact, the Pierpaoli method is only applicable to DWI and not to any other protocol of MRI, *e.g.*, T1, T2 and PD, or any other imaging modalities, such as, X-ray CT, ultrasound, and natural photographic images.

Since anisotropy measures are susceptible and sensitive to background noise inherent in all DWIs, the accuracy and precision of diffusion anisotropy measures estimated from DWIs are affected by noise. Consequently, the Pierpaoli method teaches a method for quantitatively assessing diffusion anisotropy which is rotationally invariant and immune to noise (col. 10, lines 44-47). The Pierpaoli method first (step 10) requires a diffusion-weighted MRI sequence with raw diffusion-weighted images (DWIs) (col. 4, lines 38-49). The raw MRI data is then reconstructed so that each DWI includes a diffusion weighted intensity signal for each localized region (voxel) of the imaged region (step 20). A diffusion tensor for each voxel is determined (step 30). A diffusion lattice anisotropy index that is insensitive to noise induced bias and variance effects is calculated for each voxel from the diffusion tensor (step 40). And finally, the anisotropy information in the lattice anisotropy indices is presented as a lattice anisotropy image

(step 50). However, Pierpaoli teaches only a method of assessing diffusion anisotropy. It does not teach a method of filtering MR images (or images from other modalities, *e.g.*, X-ray CT, ultrasound, and natural photographic images), such as anisotropic diffusive filtering or the scale-based filtering methods as taught by Applicants.

Applicants' space-variant anisotropic (scale-based) filtering methods are entirely different from the method of quantitatively assessing diffusion anisotropy as taught by Pierpaoli. In fact, Applicants' scale-based filtering methods outperform the anisotropic diffusive filtering methods of the prior art which may use the method of assessing anisotropy diffusion, such as disclosed by Pierpaoli. Although anisotropic diffusive filtering reduces noise, it does not account for local structure size, and therefore, blurs fine structures and diffuses across boundaries. Anisotropic diffusive filtering does not use any structural information to control the extent of diffusion in different regions so that fine structures often disappear and fuzzy boundaries are further blurred upon filtering. Applicants' scale-based methods overcome the problems of diffusive filtering of the prior art by utilizing object size or "scale" information to control the degree of smoothing that is done in different regions of the image.

Unlike Pierpaoli, which merely provides a method for assessing diffusion anisotropy for a particular MR imaging protocol, Applicants' scale-based filtering methods use structure size information to accurately arrest diffusion around fine structures, and even across low gradient boundaries. Applicants' methods teach imaging the region by any selected MR protocol to form an image, and filtering the acquired image by a scale-based resolution adaptive method. One method uses a weighted average over a scale-dependant neighborhood and the other method employs scale-dependant diffusion conductance to perform filtering. The scale-based filtering uses the local scale information at every spel to control the extent of filtering.

Consequently, Pierpaoli's method for assessing diffusion anisotropy is entirely different from Applicants' method. As detailed above, Pierpaoli fails to teach Applicants' method of post-acquisition processing of an MRI-acquired image by variant anisotropic filtering to enhance structure and reduce noise. Accordingly, Pierpaoli fails to anticipate Applicants method and Applicants respectfully request that the rejection of claims 1 and 2 under 35 USC §102 be withdrawn and the claims be held allowable.

Rejection based on 35 USC §103

Claims 3-21 have been rejected under 35 USC §103, as being unpatentable over U.S. Patent No. 5,969,424 (Pierpaoli) in view of U.S. Patent No. 5,560,360 (Filler). In making the rejection, the Examiner asserts that the "spatial-resolution" disclosure that is missing from Pierpaoli is provided by Filler. However, Applicants respectfully traverse the rejection because not only does Pierpaoli fail to disclose spatial-resolution, Pierpaoli is an entirely different method from that of Applicants' invention. Additionally, Filler fails to disclose Applicants' spatial-resolution adaptive scale-computation filter method. Accordingly, even if combined, the prior art references fail to disclose the methods taught by Applicants and specifically fail to disclose Applicants method of filtering comprising spatial-resolution adaptive scale-computation method.

Filler teaches a method of utilizing magnetic resonance to determine the shape and position of a structure by exposing a region to a predetermined arrangement of diffusion-weighted magnetic gradients (signals) that do two things: 1) emphasize a selected structure in the region exhibiting diffusion anisotropy in a particular direction and 2) suppress other structures in the region that exhibit diffusion anisotropy in a different direction. Specifically, Filler focuses on a method of using MRI to selectively generate images of neural tissues, while effectively making the other structures disappear. Filler teaches using the arrangement of the intensities of the signals to provide the desired images. Filler does not teach Applicants' spatial-resolution filtering method, but merely mentions improving the spatial resolution of the system by using a phased array coil system in lieu of a solenoid or surface coil (col. 10, lines 48-58).

For the above stated reasons, Pierpaoli alone, or combined with, Filler fails to teach Applicants' method of filtering comprising a spatial-resolution adaptive scale-computation method. Thus, Pierpaoli, alone or in combination with Filler, cannot obviate Applicants' invention. Additionally, since claim 3 is not obviated by Pierpaoli alone, or in combination with Filler, the claims that depend therefrom cannot be obviated by the same prior art references. Also, since claim 11 depends from claim 2 which is not rejected herein, and claims 12-14 and claims 17-21 depend therefrom, the rejection is not applicable to these claims. However, even if the rejection did address these claims, these claims are not obviated by the cited prior art for the same above identified reasons. Accordingly, Applicants respectfully request that the rejection of claims 3-21 under 35 USC §103(a) be withdrawn and the claims be held allowable.

It is respectfully submitted that all pending claims are in condition for allowance, and respectfully request that allowance be granted at the earliest date possible. Should the Examiner have any questions or comments regarding Applicant's amendments or response, the Examiner is asked to contact Applicant's undersigned representative at (215) 575-7034.

If there are any fees due in connection with the filing of this response, please charge the fees to our Deposit Account No. 50-0979.

Respectfully submitted,

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